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*With international search report.**With amended claims.*

(54) Title: COMPOSITION FOR PREVENTING DAMAGE CAUSED BY ANIMALS

(57) Abstract

A composition and method of application of an antianimal coating to bushes, shrubs, trees, and other woody products. The composition comprises a unique binder system containing a bitter-tasting component such as denatonium benzoate. The method and composition prevents the chewing, ingesting, inhaling, grazing, and feeding by animals of bushes, shrubs, trees, woodchips, sawdust and other fibrous materials.

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COMPOSITION FOR PREVENTING DAMAGE CAUSED BY ANIMALS

The Field of the Invention

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This invention relates to a method and composition for the application of an anti-animal coating to woody articles to prevent destruction of the articles by animals.

10

Background of the Invention

The destruction of bushes, shrubs, and trees in residential areas, nurseries, tree farms, reforestation products, woods, and forests is an epidemic problem of significant magnitude. The economic losses resulting from chewing, grazing and feeding by animals is a world-wide problem resulting in annual losses of millions of dollars. Furthermore, when destruction occurs in residential areas, nurseries, woods and forests, there is an aesthetic value which is lost, as well.

Thus, there is a need for a product which is economical to use, and prevents the chewing and grazing of woody articles by animals. There is a further need for a product which may be applied to materials which are misappropriated by animals for nests, bedding, etc.

In order to be an effective deterrent to animals, the composition must have a foul taste which deters chewing or gnawing of the wood or other material. The foul-tasting composition must also be contained in a binder which easily adheres to woody products, resists evaporation in hot and humid weather, resists freezing in cold climates, and does not readily wash off upon exposure to rain. Due to the required large areas typically covered, the composition must also be easily applied and economical to use. The composition also must be nontoxic. The binder or the repellent cannot harm either the woody articles it is coated on or be toxic to the environment in the event the composition washes off and/or evaporates. The coating and method must also be safe from a humane standpoint. Although

the composition will not likely be consumed by animals, small quantities could be ingested by the animals and thus, it must be non-toxic in small quantities to animals.

5

Summary of the Invention

A coating composition and method of applying the coating for the prevention of destruction of woody materials by animals and birds is disclosed. The
10 coating composition comprises:

- a. an effective amount of a latex comprising 1 to 60% solids; and
- b. an effective amount of anti-chewing agent.

15 The coating has the advantages of having a lingering bitter taste animals and birds don't like, is non-volatile, has effective adhesion to surfaces, is not subject to rain or snow washoff and is subject to limited vaporization. The composition may be applied in
20 a single annual application to seedlings and have multiple year efficacy on mature trees. The composition may be applied to a wide variety of species of deciduous and conifer trees and shrubs and is effective on a diverse range of forest animals and birds.

25

Detailed Description of the Invention

This invention relates to the method and composition of applying an anti-animal coating to woody articles such as trees, bushes and shrubs. Typical trees
30 include, but are not limited to fruit and ornamental trees, apple trees, cherry trees, peach trees, pine, willow, ash, birch, aspen, maple, oak, walnut, balsam, cedar, spruce, citrus and nut trees. Typical shrubs which may have the coating composition of the present
35 invention applied include, but are not limited to amuar maple, Russian olive, crap apple, chokecherry, American plum, flame willow, golden willow, laurel leaf willow,

Japanese tree lilac, pagoda dogwood, juniperous
chineseis, juniperous virginiana, juniperous scopulorum,
juniperous sabina, arborvitae, oxidentalis, service
berry, amelanchier species, glossy black chokecherry,
5 Siberian pea shrub, grey dogwood, red twigged dogwood,
hazelnut, catanea, aster species, dwarf bush,
honeysuckle, clancy's dwarf honeysuckle, ninebark
potentilla, sumak, nanking cherry, regosa rose, silver
buffaloberry, ash leaf spirea, anthow water spirea,
10 vanoutte spirea, lilacs airwood, viburnum and American
cranberry viburnum. The term "woody articles," for this
invention, includes trees, bushes, shrubs, woodchips,
sawdust and also other materials animals and birds chew
on or misappropriate for nests or bedding including
15 insulation or other materials.

The invention is directed to the prevention of the
destruction of the woody articles by animals and birds
such as rabbits, deer, beaver, woodpeckers, squirrels,
moose, elk, porcupine, skunks, woodchuck, gophers,
20 chipmunks, moles, mice, raccoons and other grazing or
chewing-type animals. By the term "animal" it is meant
to include all animals, birds and insects which might
chew, ingest or misappropriate materials in an unwanted
manner.

25 More particularly, the invention is directed to a
novel composition and method of application which has
unique nontoxic adhesion properties and has a bitter
taste. The method and composition of the present
invention comprises an adhesive latex containing a
30 bitter tasting or foul tasting component which repels
animals when the composition is tasted or ingested. The
coated composition must be safe for ingestion by
animals, it must have the properties necessary to adhere
to various woody substrates and it must retain its
35 properties of adhesion and bitter taste when exposed to
the elements. The composition generally comprises a
latex, a bitter or foul tasting compound, and optionally

surfactants, anti-foaming agents, dispersing agents, thixotropes, wetting agents or other constituents depending on the intended application.

The coating composition generally comprises an effective amount of a latex comprising about 1-60% solids and an effective amount of denatonium benzoate. Typically, the coating composition comprises about 1-30 wt%, preferably 3-20 wt% of a 0.05% water base solution of denatonium benzoate, with the remainder of the composition being latex and water. A surfactant may be optionally added in an amount of about 2 - 20 wt%.

The coating is applied to woody articles in a variety of manners. Possible coating methods include spray coating, brush coating, coating with a roller, applying by hand with a glove and other typical coating methods such as automated coating systems typically used with painting and adhesive applications. Aerial application, such as used in crop dusting, is also a method of application which may be effectively used for the present invention.

One preferred method is "dipping", which involves dipping seedlings in the composition before they are planted. The young seedlings thereafter are protected from animals in their young, vulnerable stage.

25

Latex

Latexes are emulsions, which are two-phase systems consisting of two immiscible liquids, the one being dispersed as finite globules in the other. The dispersed, discontinuous or internal phase is the liquid that is broken up into globules. The surrounding liquid is known as a continuous or external phase.

Emulsions can be thin or thick fluids, paste or gels. The viscosity may be increased by adding thickeners or gelling agents that are compatible with the emulsifier. Viscosity may be decreased by increasing the proportion of the continuous phase or by

the addition of various types of surface active agents.

Latexes which are useful for the present invention include generally any latex which results in an effective coating which adheres to woody articles. The latex needs to also sufficiently bind the bitter tasting anti-chew compound. Furthermore, the latex must provide a viscosity which is suitable for widespread application and adhesion to trees and shrubs.

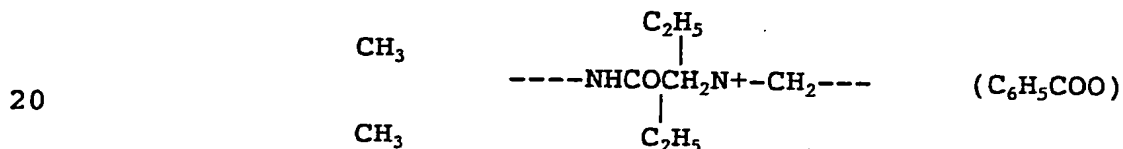
Preferred latexes include, but are not limited to esters of acrylic acid, vinyl acetate, styrene, esters of methacrylic acid and butadiene. The preferred latex is either a carboxylated styrene butadiene copolymer or a vinyl acetate/butyl acrylate copolymer, which are commercially available from a variety of latex producers. A preferred latex is 76 RES 4150 carboxylated SBR emulsion, commercially available from Unocal Chemicals Division. This emulsion has excellent adhesive characteristics and has good water resistance. The most important characteristics of the latex to be utilized are good water resistance and good adhesive properties.

If an acrylic or vinyl acrylic copolymer latex is used, the acrylic latex emulsion may comprise homopolymers of lower alkyl esters of acrylic acid or an alpha-lower alkyl acrylic acid, or copolymers thereof, that is polymers made of two or more different acrylic acid esters and/or alpha-lower alkyl acrylic acid esters. By "lower alkyl" it is meant alkyl groups having from 1 to 4 carbon atoms. Typical lower alkyl groups include methyl, ethyl, propyl, isopropyl and butyl. Preferably, any one of the numerous commercially available acrylic latex emulsions may be used. This includes the Phoplex brand acrylic latex emulsions commercially available from Rhom and Haas Co.; UCAR brand acrylic latex emulsions, commercially available from Union Carbide and acrylic emulsions available from Reichhold Chemicals.

Generally, latexes comprising 1 to 75% solids are useful for the present invention. More preferably, latexes comprising 1 to 50% solids are useful. Most preferably, latexes having 3 to 30% solids are effective for the present invention.

Anti-Chew Compound

The anti-chew compound can be any compound which is sufficiently bitter and/or vile tasting that it acts as an anti-chew repellant for animals. The compound denatonium benzoate is a bitter substance which exhibits a vile taste and a lingering after-taste. To achieve the bitter tasting effects, denatonium benzoate may be diluted significantly, up to 1 part per 100 million parts diluent. Denatonium benzoate has the following chemical formula:



Its chemical name is benzyldiethyl [(2,6-xylylcarbamoyle)methyl]ammonium-benzoate). Denatonium benzoate has the following toxicity: acute oral rat LD50, 612mg/kg.

In the present invention, the denatonium benzoate used is a 0.05% solution diluted in a water base. Preferably, 1 to 30 wt% of the 0.05% denatonium benzoate solution may be used in the coating composition of the present invention. More preferably, 3 to 20 wt% of the 0.05% denatonium benzoate solution is used. Most preferably, 6 to 10 wt% of the 0.05% denatonium benzoate is that the concentration is sufficient such that it produces a vile taste when animals chew on the coated woody article. Other anti-chew compounds may be used such as denatonium saccharide.

Surfactants

The composition of the present invention may include an optional surfactant. The properties of the composition can be enhanced or augmented using a variety of anionic, nonionic, cationic, and amphoteric surfactants known in the art including sodium or potassium salts of fatty acids, rosin acids, tall oil, alkyl benzene sulfonates, alkyl sulfates, long chain acid esters of polyethylene glycols; polyethylene glycol ethers of alkyl phenols; polyethylene glycol ethers of long chain alcohols and surfactants; fatty acid diethanol amids, block copolymers of ethylene oxide and propylene oxide.

Preferred surfactants for use with the present invention include ethoxylated phenols, copolymers of ethylene oxide and propylene oxide and polyethylene glycol ethers of alkyl phenols or long chain fatty alcohols. The alkoxyated alkyl phenols or the alkoxyated fatty alcohols can contain from about 3 to about 40 moles of the alkylene oxide, or mixtures thereof, in combination with one mole of the alkyl phenol or fatty alcohol. Preferably, an ethylene oxide surfactant, available under the trade name Igepal RC-520 and commercially available from Rhone-Poulenc is used. However, other surfactants are useful with the present invention.

Preferably, the coating composition of the present invention contains 1 to 25 wt% surfactant. Most preferably, the coating composition of the present invention contains 2 to 20 wt% of a surfactant.

Dispersing Agents

Optionally, the composition of the present invention may also contain a dispersing agent dispersed as an element of the solid phase or dissolved dispersed as an element of the liquid phase. The dispersing agent functions to efficiently disperse the denatonium

benzoate of the present invention within the latex. The dispersing agent may also be used to lower surface tension and modify rheology within the system providing a composition which may be applied easily to the
5 intended substrates.

Solid and liquid dispersing agents which are exemplary of those useful in the present invention includes those film-forming agents having a dispersing character disclosed as useful in the coating composition
10 of the present invention. Useful dispersing agents include colloidal compositions such as casein, soybean protein, cellulosic compositions such as carboxymethyl cellulose, carboxymethyl starch and hydroxy ethyl starch; silicates, such as sodium ortho silicate, sodium
15 metasilicate, sodium methyl silicate, and sodium disilicate.

In the coating composition of the present invention, the concentration of the dispersing agent may vary from 0 wt% to 5 wt-%, preferably from .5 to 4 wt-%, and most
20 preferably from 1 to 3 wt-%.

Working Example

The following working examples were formulated as shown below.

25 Example 1

The preferred embodiment of the present invention comprises the following composition:

	Denatonium Benzoate (0.05% solution)	8%
	Latex (Res 4150)	45%
30	Surfactant (RC 250)	10%
	Water	37%

The above discussion, examples and data illustrate our current understanding of the invention. However, since many variations of the invention can be made
35 without departing from the spirit and scope of the invention, the invention resides wholly in the claims hereinafter appended.

I CLAIM:

1. A coating composition for the prevention of destruction of woody materials by animals, said coating composition comprising:
 - 5 a. an effective amount of a latex comprising about 1 to 60% solids;
 - b. an effective amount of an anti-chew compound; and
 - c. the remainder water.
- 10 2. The coating composition of claim 1 wherein said latex comprises about 3 to 30% solids.
3. The coating composition of claim 2 wherein said latex is selected from the group consisting of butadiene, esters of acrylic acid, vinyl acetate,
 - 15 styrene, and esters of methacrylic acid.
4. The coating composition of claim 1 wherein said anti-chew compound comprises about 1 to 30 wt% denatonium benzoate.
5. The coating composition of claim 1 wherein said
 - 20 anti-chew compound comprises about 3 to 20 wt% denatonium benzoate.
6. The coating composition of claim 1 further comprising a surfactant.
7. The coating composition of claim 6 wherein the
 - 25 surfactant is an ethoxylated phenol.
8. The coating composition of claim 6 wherein said coating composition comprises about 2 to 20 wt% of a surfactant.
9. The coating composition of claim 1 wherein said
 - 30 latex is carboxylated styrene butadiene.
10. A method for the prevention of destruction of woody materials by animals, said method comprising the steps of:
 - a. preparing a weather-resistant coating
 - 35 composition, said coating composition comprising:
 - i. an effective amount of a latex comprising 1 to about 60% solids;

- ii. an effective amount of an anti-chew compound; and
 - iii. an effective amount of surfactant;
 - b. applying said coating composition to the
5 base of woody materials selected from the group consisting of trees, bushes and shrubs from the ground, to a height not exceeding that reachable by said animals; and
 - c. allowing said composition to dry.
- 10 11. The method of claim 10 wherein said latex comprises about 3 to 30% solids.
12. The method of claim 10 wherein said latex is selected from the group consisting of butadiene, esters of acrylic acid, vinyl acetate, styrene, and esters of
15 methacrylic acid.
13. The method of claim 10, said composition wherein said anti-chew compound comprises about 1 to 30 wt% of a 0.05% denatonium benzoate solution.
14. The method of claim 10, said composition
20 wherein said anti-chew compound comprises about 3 to 20 wt% of a 0.05% denatonium benzoate solution.
15. The method of claim 10, said composition further comprising a surfactant.
16. The method of claim 10 wherein the surfactant
25 is an ethoxylated phenol.
17. The method of claim 10 wherein said coating composition comprises about 2 to 20 wt% surfactant.
18. The method of claim 10 wherein said latex is a carboxylated styrene butadiene.
- 30 19. A coating composition for the prevention of destruction of woody materials by animals, said coating composition comprising:
- a. about 1 to 15 wt% of a 0.05% denatonium benzoate solution;
 - 35 b. about 35 to 60% of a latex having 1 to 60% solids;
 - c. about 5 to 15 wt% nonionic surfactant; and

d. the remaining portion water.

20. The coating composition of claim 19 wherein said latex comprises about 3 to 30% solids.

5 21. The coating composition of claim 20 wherein said latex is selected from the group consisting of butadiene, esters of acrylic acid, vinyl acetate, styrene, and esters of methacrylic acid.

22. The coating composition of claim 19 comprising about 1 to 30 wt% denatonium benzoate.

10 23. The coating composition of claim 19 comprising about 3 to 20 wt% denatonium benzoate.

24. The coating composition of claim 19 further comprising a surfactant.

15 25. The coating composition of claim 24 wherein the surfactant is an ethoxylated phenol.

26. The coating composition of claim 24 wherein said coating composition comprises about 2 to 20 wt% of a surfactant.

20 27. The coating composition of claim 19, wherein said latex is carboxylated styrene butadiene.

[received by the International Bureau on 31 January 1994 (31.01.94)];
original claims 1,10-27 amended;
new claims 28 and 29 added;
other claims unchanged (3 pages)]

1. A coating composition for the prevention of destruction of woody materials by animals, said coating composition comprising:
 - 5 a. an effective amount up to about 75% weight of a latex comprising about 1 to 60% solids;
 - b. an effective amount of about 1 to 30% weight of an anti-chew compound; and
 - 10 c. the remainder water.
2. The coating composition of claim 1 wherein said latex comprises about 3 to 30% solids.
3. The coating composition of claim 2 wherein said latex is selected from the group consisting of
15 butadiene, esters of acrylic acid, vinyl acetate, styrene, and esters of methacrylic acid.
4. The coating composition of claim 1 wherein said anti-chew compound comprises about 1 to 30 wt% denatonium benzoate.
- 20 5. The coating composition of claim 1 wherein said anti-chew compound comprises about 3 to 20 wt% denatonium benzoate.
6. The coating composition of claim 1 further comprising a surfactant.
- 25 7. The coating composition of claim 6 wherein the surfactant is an ethoxylated phenol.
8. The coating composition of claim 6 wherein said coating composition comprises about 2 to 20 wt% of a surfactant.
- 30 9. The coating composition of claim 1 wherein said latex is carboxylated styrene butadiene.
10. A method for the prevention of destruction of woody materials by animals, said method comprising:
 - a. preparing a weather-resistant coating
35 composition, said coating composition comprising:
 - i. an effective amount up to about 75% weight of a latex comprising 1 to about 60%

solids;

ii. an effective amount of about 1 to 30% weight of an anti-chew compounds; and

iii. an effective amount of surfactant;

5 11. The method of claim 10 wherein said latex comprises about 3 to 30% solids.

12. The method of claim 10 wherein said latex is selected from the group consisting of butadiene, esters of acrylic acid, vinyl acetate, styrene, and esters of
10 methacrylic acid.

13. The method of claim 10, said composition wherein said anti-chew compound comprises about 1 to 30 wt% of a 0.05% denatonium benzoate solution.

14. The method of claim 10, said composition
15 wherein said anti-chew compound comprises about 3 to 20 wt% of a 0.05% denatonium benzoate solution.

15. The method of claim 10, said composition further comprising a surfactant.

16. The method of claim 10 wherein the surfactant
20 is an ethoxylated phenol.

17. The method of claim 10 wherein said coating composition comprises about 2 to 20 wt% surfactant.

18. The method of claim 10 wherein said latex is a carboxylated styrene butadiene.

25 19. A coating composition for the prevention of destruction of woody materials by animals, said coating composition comprising:

a. about 1 to 15 wt% of a 0.05% denatonium benzoate solution;

30 b. about 35 to 60% of a latex having 1 to 60% solids;

c. about 5 to 15 wt% nonionic surfactant; and

d. the remaining portion water.

20. The coating composition of claim 19 wherein
35 said latex comprises about 3 to 30% solids.

21. The coating composition of claim 20 wherein said latex is selected from the group consisting of

butadiene, esters of acrylic acid, vinyl acetate, styrene, and esters of methacrylic acid.

22. The coating composition of claim 19 comprising about 1 to 30 wt% denatonium benzoate.

5 23. The coating composition of claim 19 comprising about 3 to 20 wt% denatonium benzoate.

24. The coating composition of claim 19 further comprising a surfactant.

10 25. The coating composition of claim 24 wherein the surfactant is an ethoxylated phenol.

26. The coating composition of claim 24 wherein said coating composition comprises about 2 to 20 wt% of a surfactant.

15 27. The coating composition of claim 19, wherein said latex is carboxylated styrene butadiene.

28. The method of claim 10 whereby said coating composition is applied to the base of woody materials selected from the group consisting of trees, bushes and shrubs.

20 29. The method of claim 28 whereby said composition is allowed to dry after application.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 93/06961

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 5 A01N25/24 A01N37/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 5 A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,30 21 693 (B.BRAUN) 17 December 1981 see the whole document ---	1,10,12
X	EP,A,0 280 443 (DALGETY UK LTD.) 31 August 1988 see page 4, line 8 - line 36; claims 10,11 ---	1,4,10, 12-14
X	US,A,4 064 316 (T.H.CURTIS) 20 December 1977 see the whole document ---	1,6
Y	US,A,4 661 504 (G.T.HOLLANDER) 28 April 1987 see the whole document ---	1-27
Y	DD,A,233 291 (VEB BERLIN-CHEMIE) 26 February 1986 see the whole document ---	1-27
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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30. 11. 93

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INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>CHEMISTRY AND INDUSTRY. CHEMISTRY AND INDUSTRY REVIEW no. 22 , 21 November 1988 , LETCHWORTH GB pages 721 - 723 H.A.S.PAYNE 'Bitrex - a bitter solution to safety' see page 722, column 1, paragraph 3 -----</p>	1-27

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 93/06961

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		ZA-A- 8801069	11-08-88
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US-A-4661504	28-04-87	NONE	
DD-A-233291		NONE	